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Letter to the Editor

Gender Differences in Coronary Arteries and Thoracic Aorta Calcification

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C alcifications are part of the development of atherosclerosis; they occur exclusively in atherosclerotic arteries and are absent in the normal vessel wall. Studies have demonstrated calcification in both coronary and aortic arteries to be a specific marker of underlying atherosclerosis in the respective vascular beds. Extensive evidence exist that men are more likely to have calcification in the coronary arteries; however, whether similar difference exists in other vascular beds is not well established. The purpose of this study is to evaluate whether the lower risk of atherosclerosis observed in coronary circulation in women compared with men is also observed in thoracic aorta.

This is a cross-sectional study on a consecutive sample of 8549 asymptomatic individuals (69% men, mean age: 52 ± 9 years) patients who presented to a single EBT scanning facility for CHD risk stratification. A history of cigarette smoking was considered present if a subject was a current or former smoker. Dyslipidemia was coded as present for any individual self-reporting a history of high total cholesterol, high LDL, low HDL, and/or high triglycerides, or current use of lipid-lowering therapy. Patients were considered to have diabetes if they reported using oral hypoglycemic agents, insulin sensitizers, or subcutaneous insulin and hypertension if they reported a history of high blood pressure or used antihypertensive medications. A family history of CHD was considered premature if the immediate family (parents or siblings) experienced a fatal or nonfatal myocardial infarction before age of 55 years. Individuals with BMI ≥30 kg/m² were considered as obese. This study was approved by the local institutional review board and received a waiver of patient consent.

Each patient underwent EBT scanning using an Imatron scanner (Imatron). Coronary arteries were imaged with acquisition of approximately 30 to 40 contiguous images of 3 mm slice thickness during end-diastole using ECG-triggering during a single 20- to 30-second breath hold. Coronary artery calcification (CAC) was quantified into a score using the previously described Agatston scoring method. The same scan series was also assessed for thoracic aorta calcification (TAC) in the ascending and proximal portion of the descending aorta. A calcified lesion was defined as the presence of ≥1 lesion of ≥3 pixels with a peak Hounsfield unit (HU) density of >130.

Baseline demographics, risk factors, and clinical variables are descriptively summarized. The independent association of CHD risk factors and gender with both CAC and TAC was assessed using multivariate adjusted logistic regression analyses. A probability value <0.05 was considered statistically significant. All statistical analyses were performed using STATA version 8.0.

The characteristics of the study population according to gender are shown in supplemental Table I (available online at http://atvb.ahajournals.org). Overall 55% and 22% of the study population had any CAC and TAC, respectively. Women had a significantly lower prevalence of CAC compared with men (34% versus 64%, P < 0.0001). On the other hand, interestingly, the prevalence of TAC was significantly higher in women (25% versus 21%, P < 0.0001), and the trend was similar irrespective of CAC status (Figure) and was more prominent in middle-aged individuals. After adjusting for traditional CHD risk factors, women compared with men were less likely to have any CAC (OR: 0.17, 95% CI: 0.15 to 0.19, P < 0.0001). On the other hand, the multivariate adjusted odds ratio for the presence of TAC was significantly higher in women (OR: 1.34, 95% CI: 1.17 to 1.55, P < 0.0001; supplemental Table II). The higher likelihood of TAC in women was greater in absence of CAC (OR: 1.59, 95% CI: 1.25 to 2.02, P < 0.0001) as compared with presence of CAC (OR: 1.23, 95% CI: 1.03 to 1.46, P = 0.03); however, no interaction was observed according to CAC status (P = 0.13). Coronary artery calcification was also independently associated with presence of TAC (OR: 2.42, 95% CI: 2.08 to 2.79, P < 0.0001).

In accordance with previous reports, traditional cardiovascular risk factors in our study were related to calcification in both coronary and thoracic aorta, pointing out that atherosclerosis is a systemic disease affecting the vascular system as a whole. It is well known that women have more atherosclerosis as well as greater amounts of calcification in the aorta than in the coronary arteries. However, whether there is a gender difference in presence and extent of calcification in the aorta is not entirely clear. In our study, women had more prevalent TAC even after adjusting for traditional atherosclerosis risk factors, whereas men had more prevalent CAC. Our data extends the findings of a previous report from the Reykjavik study, which demonstrated that the prevalence of calcification in the abdominal aorta was...
more prevalent in women, independently associated with recognized atherosclerotic risk factors, and a potential marker for both coronary and peripheral artery disease. However, Wilson et al found no gender differences in aortic calcifications by lateral lumbar radiographs. Similarly, Allison et al also did not find any gender differences in aortic calcification in 650 asymptomatic subjects undergoing EBT scanning. Also, a recent study by Odink et al among elderly individuals (mean age 74 years) reported that although prevalence of aortic arch calcification (any versus none) was higher among women, among those with calcification, men were more likely to have high scores. However, large scale population based studies like the Multiethnic Study of Atherosclerosis (MESA), will more likely provide further insight into this important issue.

Thoracic aortic atherosclerosis has been shown to be an important cause of severe morbidity and mortality. Watanabe et al found in a study that included 225 consecutive Japanese patients who underwent both CT and coronary angiography that TAC was highly predictive of significant obstructive CAD. However, whether this increased prevalence of TAC adds prognostic information regarding future CHD above and beyond that obtained by CAC is yet to be seen.

The results of our study should be interpreted in the context of several limitations. In our study we measured calcification only in the ascending and descending aorta. Aortic calcification tends to occur more in abdominal aorta, and studies including them have demonstrated a higher prevalence of aortic calcification. In our study, CHD risk factors were self-reported. Although Hoff et al have shown a good reliability of self-reported histories of CHD risk factors in self-referred individuals, residual confounding cannot be ruled out. The study population was highly motivated to assess their CHD risk and in their ability to afford the expense associated with the EBT scan. This may suggest that these individuals differ from the general population in their use of screening procedures, and other preventive measures. Also, the study population was mainly composed of Whites and the finding may not apply to other ethnic groups.

In summary, among predominantly White, self-referred sample, and most likely belonging to a higher socioeconomic status, women tend to have a higher prevalence of TAC compared with men, and the difference persists even in absence of CAC. The underlying mechanism associated with the gender differences observed in various arterial beds is poorly understood, and further studies are needed to explain this phenomenon. Detection of TAC in absence of CAC may provide the earliest sign of underlying atherosclerotic process and aid in initiating preventive strategies.

Disclosures
None.

References
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